Control Engineering I

Academic Year: (2023 / 2024) **Review date: 12/02/2024 13:19:46**

Department assigned to the subject: Systems Engineering and Automation Department

Coordinating teacher: ESCALERA HUESO, ARTURO DE LA

Type: Compulsory ECTS Credits : 6.0

Year : 4 Semester : 2

LEARNING OUTCOMES

CB1. Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study.
CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
CB3. Students have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgements which include reflection on relevant social, scientific or ethical issues.
CB4. Students should be able to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.
CB5. Students will have developed the learning skills necessary to undertake further study with a high degree of autonomy.
CG2. Learn new methods and technologies from basic scientific and technical knowledge, and being able to adapt to new situations.
CG3. Solve problems with initiative, decision making, creativity, and communicate and transmit knowledge, skills and abilities, understanding the ethical, social and professional responsibility of the engineering activity. Capacity for leadership, innovation and entrepreneurial spirit.
CG4. Solve mathematical, physical, chemical, biological and technological problems that may arise within the framework of the applications of quantum technologies, nanotechnology, biology, micro- and nano-electronics and photonics in various fields of engineering.
CG5. Use the theoretical and practical knowledge acquired in the definition, approach and resolution of problems in the framework of the exercise of their profession.
CG6. Develop new products and services based on the use and exploitation of new technologies related to physical engineering.
CG7. Undertake further specialized studies, both in physics and in the various branches of engineering.
CE14. Specify and use electronic instrumentation, measurement systems, sensors, techniques and experimental procedures usual and advanced in physics, engineering and biology, including electromechanical and microfluidic microdevices, and design experiments using the scientific method.
CT1. Work in multidisciplinary and international teams as well as organize and plan work making the right decisions based on available information, gathering and interpreting relevant data to make judgments and critical thinking within the area of study.

RA1. To have acquired sufficient knowledge and proved a sufficiently deep comprehension of the basic principles, both theoretical and practical, and methodology of the more important fields in science and technology as to be able to work successfully in them.
RA2. To be able, using arguments, strategies and procedures developed by themselves, to apply their knowledge and abilities to the successful solution of complex technological problems that require creating and innovative thinking.
RA3. To be able to search for, collect and interpret relevant information and data to back up their conclusions including, whenever needed, the consideration of any social, scientific and ethical aspects relevant in their field of study.
RA4. To be able to successfully manage themselves in the complex situations that might arise in their academic or professional fields of study and that might require the development of novel approaches or solutions.

RA6. To be aware of their own shortcomings and formative needs in their field of specialty, and to be able to plan and organize their own training with a high degree of independence.

OBJECTIVES

Competences and skills that will be acquired and learning results. Further information on this link
By the end of this content area, students will be able to have:
1. a systematic understanding of the key aspects and concepts of their branch of engineering in control engineering;
2. coherent knowledge of their branch of engineering including some at the forefront of the branch in control engineering;
3. the ability to apply their knowledge and understanding of control engineering to identify, formulate and solve engineering problems using established methods;
4. the ability to apply their knowledge and understanding to develop and realise designs to meet defined and specified requirements;
5. an understanding of design methodologies, and an ability to use them.
6. workshop and laboratory skills.
7. the ability to select and use appropriate equipment, tools and methods;
8. the ability to combine theory and practice to solve control engineering problems;
9. an understanding of applicable techniques and methods in control engineering, and of their limitations;

DESCRIPTION OF CONTENTS: PROGRAMME

0- Introduction

1- Transformations.
- 1.1 Basic concepts
- 1.2 Fourier Transform
- 1.3 Laplace Transform.

2- Modelling of systems
- 2.1 Mathematical models
- 2.2 Linealization.
- 2.3 Transference function.
- 2.4 Diagram Blocks.
- 2.5 Mason

3- Temporary analysis of systems
- 3.1 The concept ofTemporal analysis
- 3.2 Response to the step signal
- 3.3 Equivalent systems
- 3.4 Routh-Hurwitz's Method
- 3.5 Influence of poles and zero.
- 3.6 Response to standard signals.
- 3.7 Systems of first and second order.
- 3.8 Root Locus.

4- Introduction to control systems
- 4.1 Architectures of control.
- 4.2 Precision.
- 4.3 Sensitivity to disturbances.
- 4.4 Temporary design of regulators PID.
- 4.5 Empirical adjustment of regulators PID.

5 - Frequential analysis of systems
- 5.1 Diagram of Bode.
- 5.2 Nyquist Diagram.
- 5.3 Frequential design of regulators PID.

LEARNING ACTIVITIES AND METHODOLOGY

Skillful classes, classes of resolution of doubts in reduced groups, individual presentations of the students, individual tutorials and personal work of the student; oriented to the theoretical knowledge acquisition (3 credits ECTS).
- Practices of laboratory and individual classes of problems in reduced groups, individual tutorials and personal work of the student; oriented to the acquisition of practical abilities related to the program of the subject (3 credits ECTS).

ASSESSMENT SYSTEM

% end-of-term-examination/test:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

- Continuous evaluation (deliverables problems) 10%
- Compulsory Practices 10%
- 2 Midterms 15% and 15%
- Final exam 50%
- You will need to get at least a 4 on the final exam to pass the course.

BASIC BIBLIOGRAPHY

- Jacqueline Wilkie & Michael A. Johnson & Reza Katebi Control Engineering: An Introductory Course, Palgrave Macmillan, 2002

- K. Ogata Modern Control Engineering, Pearson-Prentice Hall, 2002

ADDITIONAL BIBLIOGRAPHY

- Farid Golnaraghi, Benjamin C. Kuo Automatic Control Systems, John Wiley & Sons, 2009

BASIC ELECTRONIC RESOURCES

- Eric Cheever . Linear Physical Systems Analysis: http://lpsa.swarthmore.edu/index.html

- Michigan U. and Carnegie Mellon . Control Tutorial for Matlab: http://ctms.engin.umich.edu/CTMS/index.php?aux=Home